MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL QUALITY
ENVIRONMENTAL SERVICES PROGRAM
Standard Operating Procedures

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SOP TITLE: Collection of Soil Samples

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SUMMARY OF REVISIONS: Format revised to meet new standards

APPLICABILITY: Applies to all personnel in the Field Services and EER Sections of the Environmental Services Program who collect soil samples

DISTRIBUTION: Supervisors, FSS and EERS, ESP
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RECERTIFICATION RECORD:

Date Reviewed				
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1.0 SCOPE AND APPLICABILITY

The collection of soil samples is generally requested to determine the presence of a contaminant, to determine the depth or extent of a contaminant, or to show the absence of a contaminant. The following procedure will aid the sample collector in developing a sampling plan that will allow for the collection of soil samples to provide true and representative data.

The procedures contained in this document are applicable to Environmental Services Program, Field Services Section (FSS) and Environmental Emergency Response Section (EERS) personnel for the collection of soil samples. Soil sampling will generally be conducted at the request of the Hazardous Waste Program (HWP) or as directed by the On-Scene Coordinator (OSC) during an EER incident response/cleanup.

2.0 SUMMARY OF METHOD

The methods for the collection of representative soil samples may vary widely depending on the depth of the sample collected and the type of soil encountered. The procedures described within this SOP provide guidance on conducting soil sampling investigations and making decisions on the best method for sample collection. The procedures include recommendations for site screening instrumentation and the use of personal protective equipment (PPE). The various types of sampling equipment and procedures are also discussed. A particular emphasis has been placed upon health and safety issues as they relate to each of the procedures described within this SOP.

3.0 DEFINITIONS AND ACRONYMS

- APR - Air Purifying Respirator.
- Bucket Auger - A hand operated auger used for collecting depth discrete soil samples.
- Buddy System - A safety system where each person works directly with another, or a "buddy", in a two person team. Each person in a team should always maintain visual contact with his partner, with an emphasis on always being aware of each other's whereabouts in the event an accident or problem should occur.
- CAS – Chemical Analysis Section
- EnCore - Sampling device used to collect samples for volatile organics analysis.
- Geoprobe - A hydraulic push probe device for collecting depth discrete soil samples.
- HASP - Health and Safety Plan
- HAZWOPER - Hazardous Waste Operations and Emergency Response
- HSERP - Hazardous Substance Emergency Response Plan
- PID (Photoionization Detector) - A portable air monitoring instrument used to measure the amount of ionizable organic vapors present.
- Safety Officer - The person, generally the ESP sampler, who is assigned or assumes the duties of the health and safety officer for a specific investigation.
- SCBA - Self-Contained Breathing Apparatus

4.0 HEALTH AND SAFETY WARNINGS

The health and safety warnings described below are not listed in any particular order and should all be considered when conducting soil sampling.

4.1 The "buddy system" should always be used to conduct sampling where hazardous materials are known or suspected.

4.2 The level of personal protection required for collecting soil samples shall be described in the site specific HASP and must be discussed in the site safety briefing. If personal protection greater than level B is required, based upon preliminary information gathered about the contaminants at the site, then ESP personnel shall not conduct the sampling and shall contact a qualified hazardous materials contractor to complete the work. The level of protection may be lowered if the soil contaminants are known or are found to be a low hazard risk.

4.3 ESP shall not enter an excavation that is not properly shored, or that may qualify as a confined space. ESP personnel are not trained nor equipped to conduct confined space entry.

4.4 For any sampling investigation that occurs at a hazardous waste site, site specific health and safety requirements shall be described in a written HASP. A site safety meeting shall be held by the person in charge of the sampling investigation and shall take place in the field prior to conducting any fieldwork. All sampling personnel directly involved in the fieldwork shall read and sign the HASP. The HASP shall be kept in the field in a location readily available to all field personnel.

5.0 PERSONNEL QUALIFICATIONS

All personnel involved in the collection of soil samples, where hazardous substances may be encountered, must:

- attend the 40-hour HAZWOPER training as required by EPA’s 40 CFR Part 311, referencing OSHA 29 CFR Part 1910.120;
- attend an annual 8-hour health and safety refresher course, or receive equivalent training;
- participate in the DEQ medical monitoring program;
- receive appropriate on-the-job training;
- be familiar with the HSERP, written and maintained by the ESP;
- be familiar with the ESP SOP manual and have read all SOP documents that are applicable to the field activities, including but not limited to those referenced in this SOP;
- attend EPA’s “Sampling for Hazardous Materials” training (or equivalent).

6.0 SUPPLIES AND EQUIPMENT

The following supplies and equipment may be needed to safely collect representative samples for field or laboratory analyses. Some of the equipment and supplies listed (e.g. Geoprobe) are optional, depending upon the specific purpose and data needs of the particular investigation.

- bucket augers
- stainless steel and or Teflon spoons or trowels
- aluminum mixing pans
- trash bags
- wide-mouth glass sample jars with Teflon lined lids
- heavy duty Ziplock bags (for packaging and storage of filled sample containers)
- paper towels
- sample labels (pre-numbered and blank)
- cooler(s) with ice
- field notebook
- field sheet and chain-of-custody record forms
- personal protective equipment, up to and including level B
- decontamination supplies for both personnel and equipment
- camera and film
- Geoprobe
- EnCore Sampler

7.0 PROCEDURES

7.1 A list will be prepared and reviewed to assure that all PPE and sampling supplies are available and all equipment is in working order. Specific requirements at private facilities (safety glasses, hard hat, safety boots, proof of HAZWOPER training and medical monitoring, etc.) may also need to be met.

7.2 To the extent possible, the CAS will be advised of the number of samples to be collected, the parameters requested, and the date samples will be returned to the lab (See MDNR-FSS-001 *Required/Recommended Containers, Volumes, Preservatives, Holding Times and Special Considerations*).

7.3 The sampler will contact the property owner and/or responsible party to obtain access to the site if arrangements have not previously been made.

7.4 If access to the site is denied upon arrival, the sampler will immediately notify the site project officer or his supervisor for determination of a course of action.

7.5 The sampler must determine the type of sample that best fits the objective of the sampling survey. Soil may be collected as a grab, composite, surface, or depth-integrated sample.

7.5.1 A grab is a discrete sample representative of one specific site at a specific point in time.

7.5.2 A composite is a non-discrete sample composed of more than one specific aliquot collected at various sampling locations and/or at different points in time. The aliquots comprising a composite sample are placed in an aluminum or stainless steel pan and thoroughly mixed prior to placing them into the appropriate sample container(s). *NOTE: The portion of any sample that is to be analyzed for volatile organics should be placed into the appropriate sample container prior to mixing due to the possible loss of volatiles during the mixing procedure. The EnCore samplers are recommended for the collection of soils to be analyzed for volatile organics.* See MDNR-FSS-006B *Sampling Soils and Other Solid Media for Volatile Organics Analysis (VOA).*

7.5.3 Surface soil samples are generally collected using either a trowel, scoop, or spoon, and usually include a vertical portion somewhere within the top two feet of soil (e.g. 0-2 inches, 6-12 inches, 1-2 feet).

7.5.4 Depth-integrated soil samples, below two feet, will most commonly be collected with the aid of a Geoprobe push probe (see Draft SOP MDNR-FSS-212 *Operation of the Geoprobe Soil Probing System)*, however, a hand auger may also be used. The Geoprobe or hand auger will be inserted to the desired depth and the soil will be removed. The sample will then be transferred to an appropriate sample container using a stainless steel or Teflon trowel, scoop, or spoon. Alternative methods may include the use of a shovel and pick or power equipment such as a backhoe to dig the hole for depth-integrated sampling. When the latter method is used, a trowel or stainless steel spoon may be used to collect the sample at the desired depth after the sides of the hole are scraped to remove any contamination carried down from other levels.

8.0 HANDLING AND PRESERVATION

8.1 All soil samples will be preserved by cooling, usually on ice in a cooler. Soil samples are generally not preserved with chemical preservatives, although methanol may be used under one method for the analysis of volatile organics (see MDNR-FSS-001 *Required/ Recommended Containers, Volumes, Preservatives, Holding Times, and Special Considerations* and MDNR-FSS-006B *Sampling Soils and Other Solid Media for Volatile Organics Analysis*).

8.2 Samples must be delivered to the laboratory for analysis within the appropriate holding times (See MDNR-FSS-001 *Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Considerations*).

8.3 Unless other arrangements have been made for sample analysis, the samples will be relinquished to the sample custodian at the ESP laboratory as soon as practical (see MDNR-FSS-018 *Sample Handling: Field Handling, Transportation, and Delivery to the ESP Lab*).

8.4 Upon return from a sampling survey, all unused supplies and clean equipment will be returned to the appropriate storage areas, all soiled equipment will be cleaned and decontaminated, and any malfunctioning equipment will be marked and the supervisor notified.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

9.1 Quality control (QC) samples will be collected as required by the Quality Assurance Project Plan of the requesting agency. The rate of one QC sample per every 10 soil samples or at least one per sampling event is normally used. The QC sample(s) will be a replicate or duplicate of the original sample submitted for analyses, and will be given a separate sample number (see MDNR-FSS-210 *Quality Assurance/Quality Control for Environmental Data Collection*).

9.2 Collection of background samples

- A background soil sample should be collected from an area that, as nearly as possible, approximates the conditions and soil type as the site being sampled and should be analyzed for all parameters of concern.
- The background sample should be beyond the influence, either by distance or physical elements (e.g., upwind or upgradient), of any known source of contamination.
- The background sample should be collected at similar depths, in a similar manner and using the same or similar equipment as those collected from the suspected area of contamination. *NOTE: if the sampling equipment must be decontaminated in the field, the background sample should be collected first to eliminate the possibility of cross contamination.*
- Generally, only one background sample is collected per site, however, if the area is very large or if there is any reason to question the reliability of the one sample, more may need to be collected.
- At times, other sources of information can be useful in determining the background levels. For example, Tidball, Ronald R., *Geochemical Survey of Missouri*, U. S. Geological Survey Professional Paper 954-H, I, 1983, provides data on metals concentrations found in agricultural soils in Missouri.

9.3 Standard sample containers for soil samples are glass jars equipped with Teflon -lined lids. Alternative sample containers may be used only after consulting with the CAS (see MDNR-FSS-001 *Required/Recommended Containers, Volumes, Preservatives, Holding Times and Special Considerations*). The EnCore sampling system may be used, for example, for collecting soil samples for volatile organic analyses.

9.4 Standard sampling equipment will be constructed of or coated with stainless steel, or Teflon . Alternative sampling equipment may be used only after consulting with the CAS. Sampling equipment to be reused during a sampling survey must be field decontaminated (see MDNR-FSS-206 *Decontamination Procedures for Sampling Equipment*).

9.5 Information for each sample collected will be entered on the Field Sheet and Chain-of-Custody Record (See MDNR-FSS-002 *Field Sheet and Chain-of-Custody Record*).

9.6 All samples will be numbered immediately following collection by attaching a pre-numbered label to the container (see MDNR-FSS-003 *Sample Numbering and Tagging*).

9.7 Information for each sample collected, as entered on the Field Sheet and Chain-of-Custody Record, plus any observations made at the time of sampling, will be entered in a field notebook (See MDNR-FSS-004 *Field Documentation*).

9.8 The sampler will be prepared to offer split samples to the property owner and/or responsible party unless otherwise directed by the requesting agency.

10.0 REFERENCES

- 40 CFR Part 311 "*Worker Protection*"
- MDNR-FSS-001 *Required/Recommended Containers, Volumes, Preservatives, Holding Times and Special Considerations*
- MDNR-FSS-002 *Field Sheet and Chain-of-Custody Record*
- MDNR-FSS-003 *Sample Numbering and Tagging*
- MDNR-FSS-004 *Field Documentation*
- MDNR-FSS-006B *Sampling Soils and Other Solid Media for Volatile Organics Analysis*
- MDNR-FSS-018 *Sample Handling: Field Handling, Transportation, and Delivery to the ESP Lab*
- MDNR-FSS-206 *Decontamination Procedures for Sampling Equipment*
- MDNR-FSS-210 *Quality Assurance/Quality Control for Environmental Data Collection*
- MDNR-FSS-212 *Operation of the Geoprobe Soil Probing System (Draft)*
- Tidball, Ronald R., *Geochemical Survey of Missouri*, U. S. Geological Survey Professional Paper 954-H, I, 1983